



Distributing a highly anticipated new release: The COVID-19 vaccine

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Most holiday seasons, discussion of urgent deliveries conjures images of UPS drivers rushing to doorways with Amazon packages, long lines at the post office, and Santa's sleigh landing on snow-topped roofs. Not this year. In December 2020, "urgent delivery" meant one thing: the COVID-19 vaccine rollout.

After months of anticipation, the vaccine has been delivered to every state in the nation, including New Mexico, which received its first shipments on Dec. 14. But vaccinating more than 250 million adults in the United States is a monumental task that requires careful planning and assessments of different approaches to distribution.

At Los Alamos, scientists are using mathematical models and computational simulations enabled by LANL's supercomputing capabilities to understand how best to distribute the COVID-19 vaccine to minimize impacts on the healthcare system and the overall population. This information can help decision makers determine which mitigation strategies to implement and how to safely reopen various parts of the community as the vaccine is rolled out.

To understand the different outcomes based on how the vaccine will be distributed, researchers are looking at various what-if scenarios.

For example, the model takes into account variables such as the percentage of the population that gets the vaccine, the vaccine's effectiveness, the different populations that will get the vaccine first (such as healthcare workers and seniors), school re-openings, business re-openings, etc. Each of these variables impacts how the disease will spread through a community. The model can also look at how the COVID-19 case and death rate, for example, will be affected if 60 percent of the population is vaccinated with a vaccine that is 90 percent effective and some parts of the community—such as schools and certain businesses—reopen.

"The first thing we looked at was whether it made a difference to prioritize certain populations—such as healthcare workers—or to just distribute the vaccine randomly," said Sara Del Valle, a computational epidemiologist and leader of the COVID-19 modeling team. "We learned that prioritizing healthcare workers first was more effective in reducing the number of COVID cases and deaths."

One of the things that sets LANL's models apart from others like them are their level of granularity. Unlike other models, those developed at LANL can drill down to the county level of every state in the nation. By incorporating explicit information at the county level, such as demographics (age, gender, household size) and even different industries

in which people work (healthcare, education, public transportation, etc.), it can give a clearer picture of the impact of the vaccine on a community and different populations within that community.

The various scenarios that the models run were developed in collaboration with local, state, and federal government officials as they effectively plan for vaccine distribution and complementary mitigation strategies.

“These models very clearly illustrate that, for many months, the vaccine alone isn’t going to be enough to keep us safe,” said Ben McMahon, also a mathematical epidemiologist who heads up LANL’s part of the DOE’s multi-lab National Virtual Biotechnology Laboratory modeling effort to tackle COVID-19. “Given the limited vaccine supply and the fact that immunity builds steadily for several weeks after vaccination, restrictions such as mask wearing, frequent hand washing, and social distancing will still be required for the next several months to slow the spread of the virus and flatten the curve.”

Both Del Valle and McMahon stress that every person has an important role to play in slowing the disease’s spread. “Because we don’t see the immediate impact of our actions, it’s hard sometimes to understand that our behaviors make a difference,” said McMahon. “But they make a tremendous difference. By wearing your mask, social distancing, and, when it’s available, getting the vaccine, you can do a lot to protect yourself and others from getting sick.”

The models also show that it will be several more months before things start to return to some semblance of “normal,” but, as Del Valle said, “There’s a light at the end of the tunnel.” And that, for most everyone, is the most anticipated and welcomed gift the holiday season.

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